Reception Room Franklin Institute

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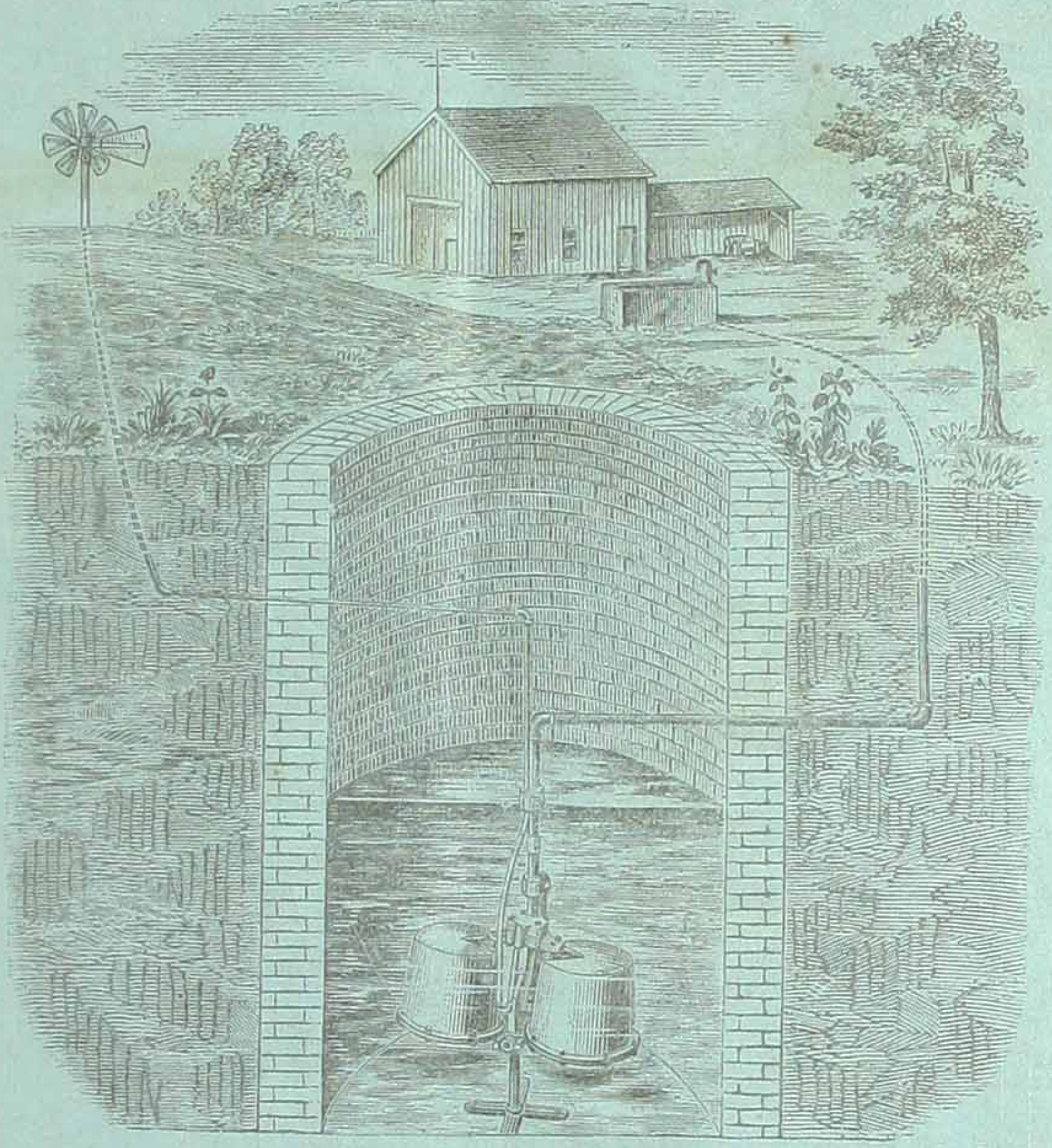
WATER RAISED TO ANY HEIGHT BY Compressed Air.



IMPROVED AUTOMATIC PUMP.

Hartford Pump Company,

HARTFORD, CONN.

J. A. AYRES, Pres't. **WM. A. AYRES**, Sec'y. **J. C. TRACY**, Treas.
EZRA BROOKS, Gen'l Manager.

DIRECTORS.

J. A. Ayres, Fred. W. Russell, J. C. Tracy,
S. H. White, J. M. Allen,
G. Wells Root, Henry Stanley.

Jenison, Printer, 245 Main St.

This page is for those who have no time to read the following Circular:

Compressed Air can be advantageously used to raise water.

The Air can be economically compressed by a Wind Wheel.

The machine made by the HARTFORD PUMP COMPANY, will compress the Air and raise the Water cheaply and surely.

Some advantages gained in it are stated on Third page of cover.

The description is on pages 2—5.

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REFERENCE.
PAMPHLET.

WATER WITHOUT LABOR.

WANT of water is one of the commonest inconveniences of life to all who live outside of cities, and most owners of country places spend a good deal of time in considering how to get such a supply as they want. Leaving hand labor and gravitation out of the account, there are three sources of power available,—steam, water, and wind. For raising water for private use, steam would not often be economical, as in addition to the first cost of the engine, there must be a continued outlay for fuel and attendance. A water-wheel is not often available, as it requires a considerable stream, and at least a moderate fall. A hydraulic ram also needs a fall and a good deal of water. If either of these conditions is lacking, its use is out of the question.

Wind power remains to be considered. It costs nothing; the wheel will run in the night as well as in the day-time, and with no attention. Although wind-wheels are not now very numerous in the Eastern States, they are used at the West and in California in great numbers, and in many places where irrigation is required, or large quantities of stock are kept, are an absolute necessity.

But, granting the efficiency and economy of wind power, there may be great question as to the best means of utilizing it. It was found, on trial, that the wind-wheel was often wrecked in violent storms, and wheels were constructed of such a nature as to partially close when the force of the wind reached a certain point, and thus diminish the resisting surface. The rudder has also been pivoted in such a way as to automatically turn to one side during a violent wind, and thus bring the wind-wheel with its side instead of its face to the gale. Great numbers of machines, working on one or the other of these plans, are now in use.

In any such wheel there are several moving parts exposed to the weather, and liable to be clogged by sleet or snow. The number of parts is also a disadvantage. If wheels with fixed fans and rudders could be safely used, they would, of course, be preferable, on account of their superior simplicity; and this is just what is rendered possible by our plan of making the wind-wheel compress air, which is then used to force water as required. The crank meets an elastic resistance at each stroke, instead of the solid shock communicated from the piston of any ordinary pump, and the weight of a long plunger-rod is also dispensed with, as the air-pump is fastened directly into the casting that supports the wind-wheel. The form of mill used is shown in Fig. 1. The crank and pitman are entirely covered, and there are no joints exposed.

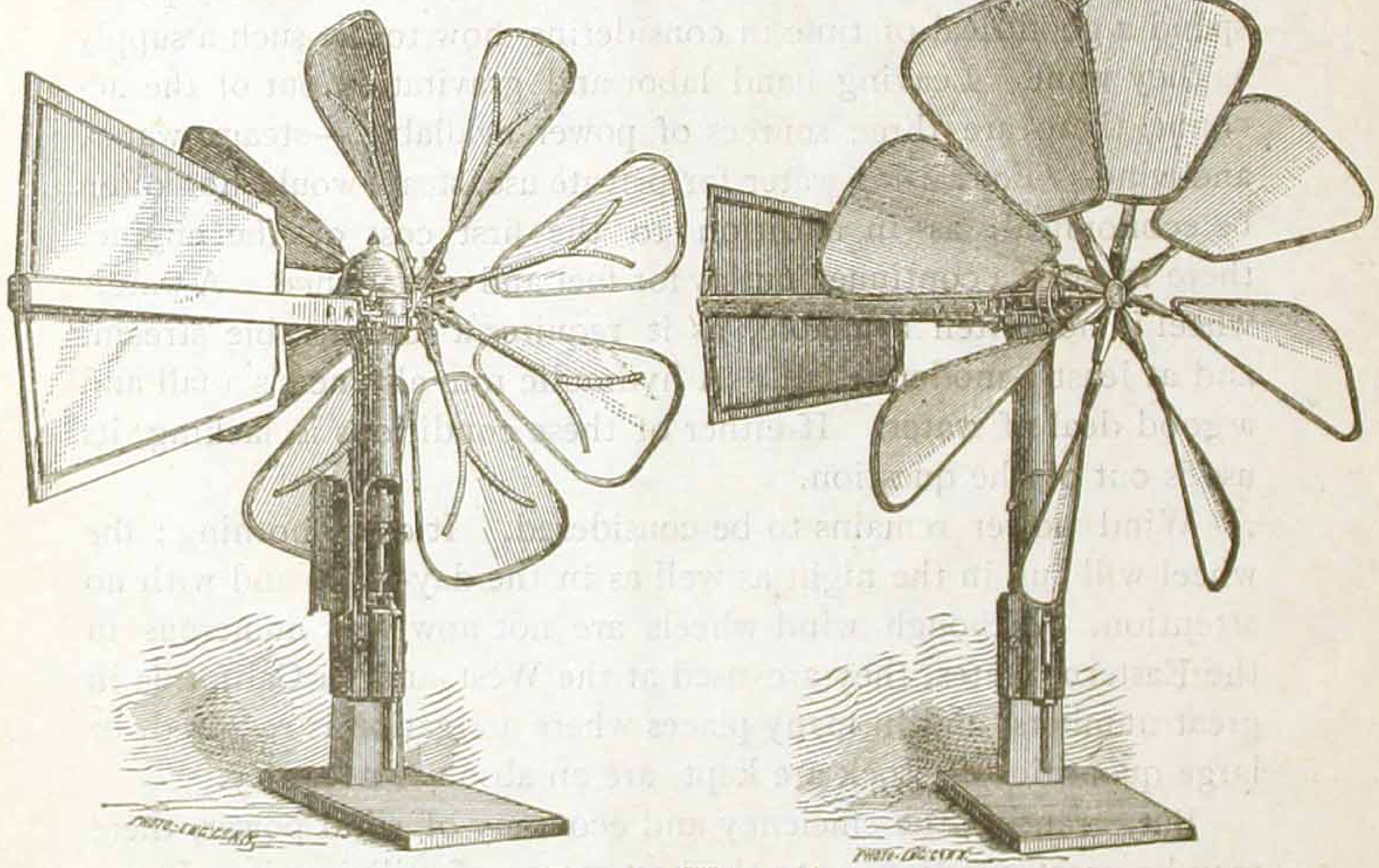

FIG. 1.—Wd mill

From the air pump the compressed air is conducted through a half inch iron pipe (common gas pipe), any necessary distance, to the automatic pump, Fig. 2, which is submerged near the bottom of the well, and this pump, where the compressed air does its work, is the principal feature of this apparatus. Any other motive power may be used to compress the air, but no other pump can use the air advantageously when it is compressed. The following description and cut will give a clear idea of its construction and mode of operation. It consists of two submerged cylinders or water chests fastened to and resting upon a frame which forms the bottom, and in turn rests upon a pivot, giving the chests a certain amount of vertical motion, say three or four inches. Each cylinder has in the bottom a valve opening upward to admit the water, and also at the bottom on the inner side a discharge pipe for the water. These discharge pipes unite in a common upright main.

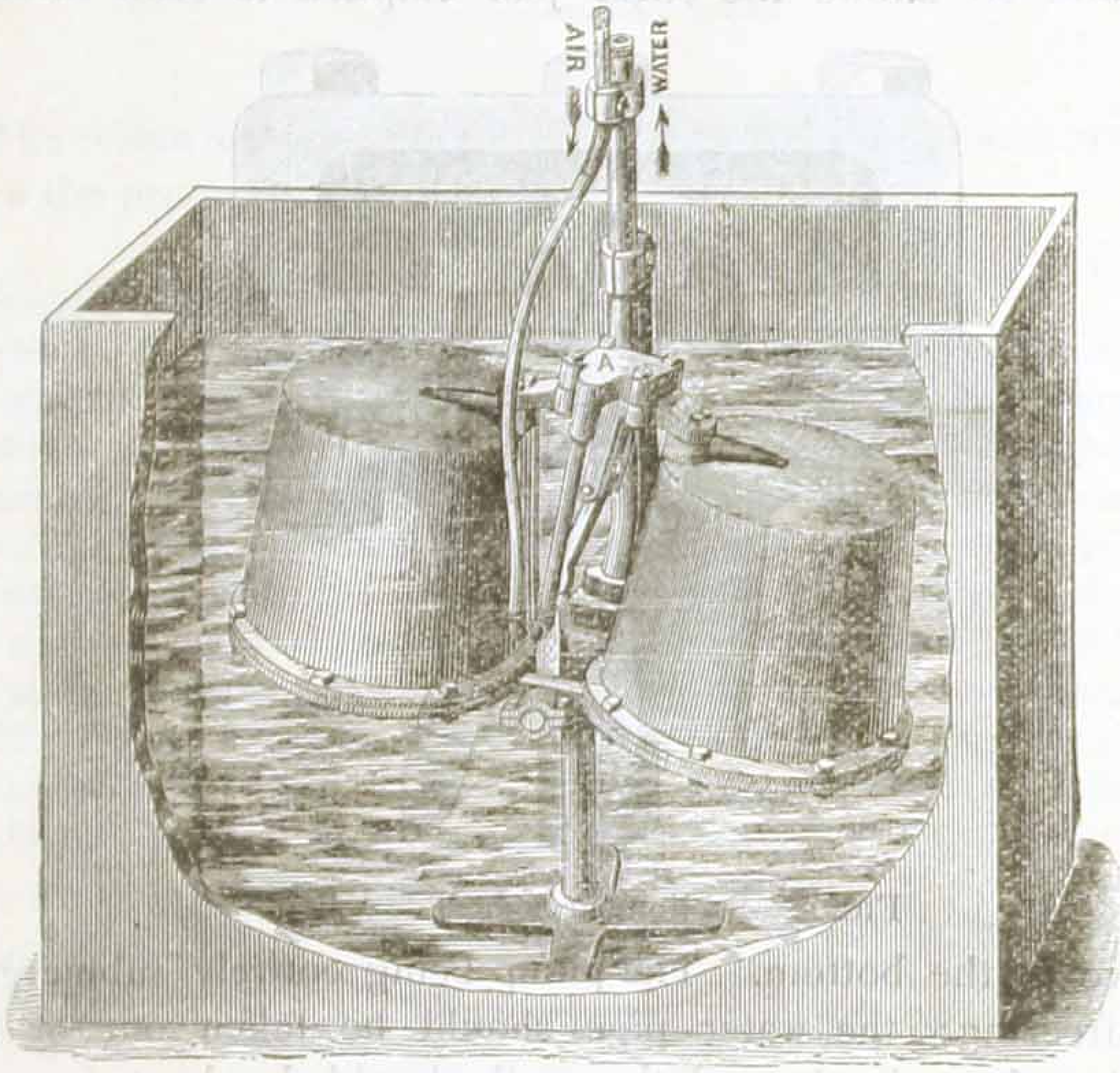

FIG. 2.—Automatic Pump.

Attached to the chests at the top, and directly between them is the air valve (marked A), which determines the passage of the compressed air alternately from one chest to the other. The connection of parts is such that by a very simple arrangement this valve is operated by the rise and fall of the water chests, as will be seen by reference to the cut. The compressed air is always directed into the lower chest.

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When a certain amount of water has been expelled, the chest is lighter than the opposite one, and has a tendency to rise. When this tendency becomes sufficiently strong to overcome the resistance of the lever which operates the valve, the chest rises, the valve is changed and the compressed air is instantly diverted to the opposite chest, which now occupies the lower position. The valve at each motion opens a suitable escape for the compressed air which has already raised its bulk of water, and so allows the chest just emptied to refill through the valve in the bottom. The pump being entirely submerged, is non-freezing; the water pipe should be taken out of the well below frost depth, and the well should be kept covered in winter. Fig. 5 represents a section through the air valve, and shows how the air passes in the different positions of the valve.

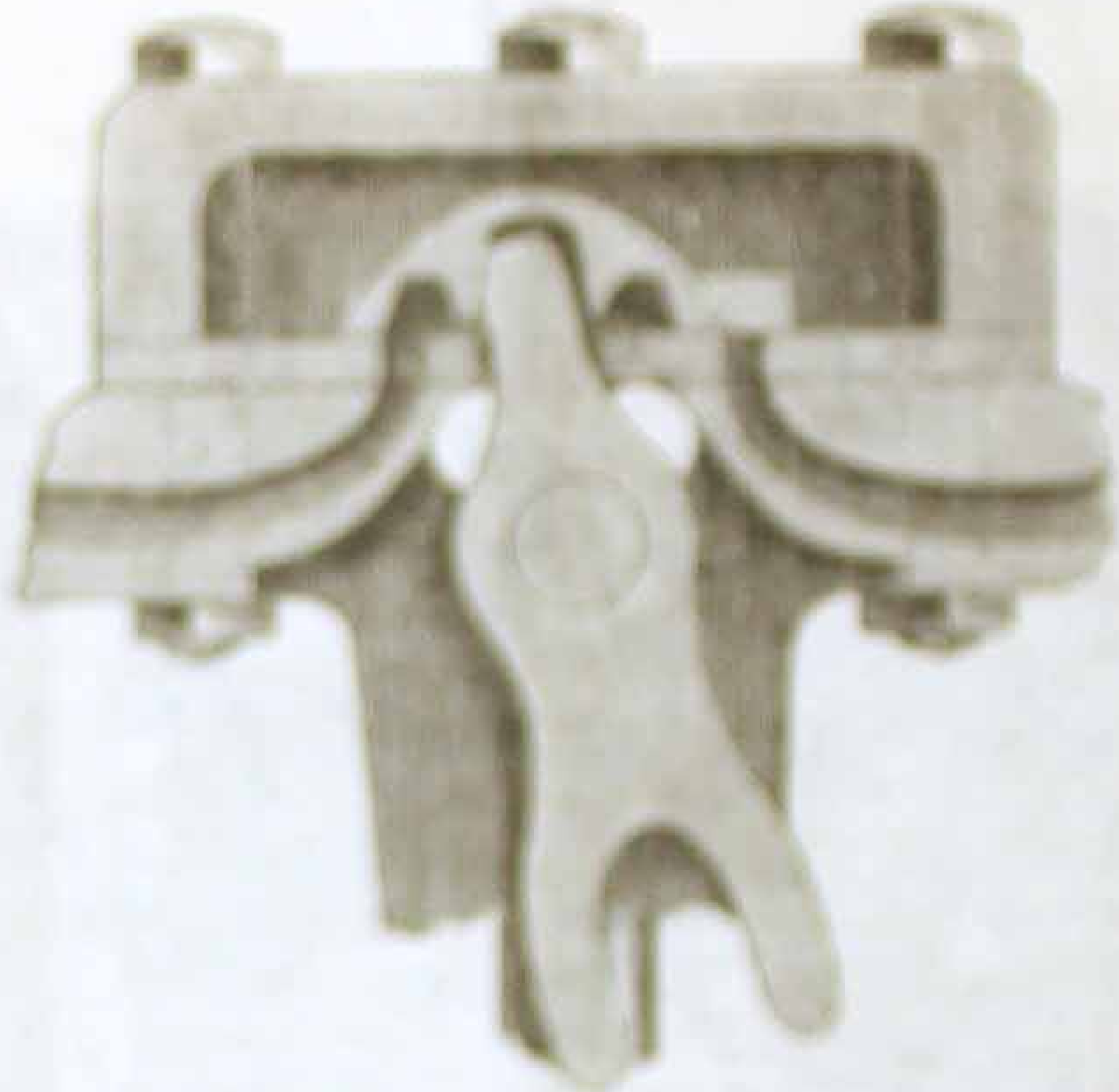

Fig. 5.—Section through Slide Valve.

The operation thus described in detail is, in practice, extremely simple and certain. In the water chests the compressed air takes the place of a piston, thus saving all the friction which necessarily exists where a piston moves in a cylinder, and its rod through stuffing-boxes. The application of power as variable as wind, through a perfectly elastic medium, is in itself a great economy.

The various parts of the windmill and pump are well made and durable, and the machine is little likely to get out of order or be affected by frost. The valves and valve seats are made of composition.

All the wearing surfaces are turned and bored, the journal-boxes are Babbited, and provided with self-oilers, which keep all the parts well lubricated.

The windmill can be placed several hundred feet from the well, if desired, or if necessary to secure good exposure to wind.

One machine in actual operation has the windwheel and air pump over a quarter of a mile distant from the automatic pump, and in this case the water is carried still farther and lifted 65 feet.

* * *

The following are some of the letters received from parties who have the machines in use:

ROCHESTER, Mass., June 14, 1875.

HARTFORD PUMP CO.:

Gents.—In accordance with my promise to write you as to the working of our windmill, I have to say that it works to a charm. We had no good winds until it was up a week. During that time it supplied us with enough water for all our use, pumping as much as we needed, but no more. The evening of the Saturday after Mr. H. left, there were about four inches of water in the tank. On the morning of Sunday, the tank was three quarters full, and leaking a perfect shower. Since then we have had no lack of water; our tank is tight, and everything all right. We are pleased with the machine, and would ask for nothing better. Our tank is sixty feet above the pump, and about three hundred feet from it, and holds one hundred barrels; and after seeing the machine work, I have no fear we shall suffer for want of water.

I remain, yours truly,
JAMES D. FALCONER.

LAKEVILLE, Conn., September 23, 1874.

WILLIAM A. AYRES, Esq., Secretary of HARTFORD PUMP CO.:

The pump which you put up for us fifteen months ago has proved very satisfactory.

It pumps water from a lake 400 feet away from the Institution, and forces it to the top of the house, about 93 feet higher than the lake level. I have been pleased to find that a moderate wind, if steady, keeps a steady flow of water into the tank. Yours very truly,

H. M. KNIGHT, M.D., Supt.

[In this case the water is furnished to the Connecticut School for Imbeciles. The building is large, and occupied by 80 or 100 persons.]

RUTHERFURD PARK, N. J., September 24, 1874.

HARTFORD PUMP CO. :

Gentlemen,—The pump put up at my place has now been running for about a year with entire satisfaction. It was what I had been looking for for the past four years ; something that would give a supply of water in my house, without requiring the services of an engineer. So far, this pump has done it, and I believe will continue to do so at no expense (after first cost), and with very little attention.

It is the BEST and CHEAPEST pump in the market.

Yours truly,
GEORGE DAYTON.

VINEYARD HAVEN, Mass., September 21, 1874.

WILLIAM A. AYRES, Esq., Secretary.

Dear Sir,—The two pumps furnished by you for Oklahoma have now been in use about three months, and we like them full as well as we expected to. You thought they would average to raise 500 gallons per day, 57 feet each. I think they do better. They have sometimes raised more than 100 gallons per hour, each. Wishing you continued success,

I remain, dear sir,
Yours very truly,
WALLACE BARNES,

[Here the water is raised 114 feet, the first pump throwing from a spring to a tank, from which the second pump forces it the remaining height. The horizontal distance is about a quarter of a mile, and the windwheel is 7 ft. 10 in. in diameter.

WEST HARTFORD, September 25, 1874.

To the HARTFORD PUMP CO. :

Gentlemen,—The Windmill Pump, working by compressed air, which I bought of you last September, works well and gives plenty of water with very little care. I am well pleased with it, and recommend it to all who want to save the labor of hand pumping.

Yours truly,
EDWARD SELDEN.

MASSACHUSETTS AGRICULTURAL COLLEGE,
Amherst, May 21, 1874.

This certifies that the Hartford Pump Company have placed in my well an Automatic Pump, which is worked by compressed air. The power is furnished by an eight-foot wind-wheel, erected on my barn. During the past four months the whole apparatus has given entire satisfaction.

This invention must be of great value to those who are not already supplied with running water, and especially to those farmers who are now obliged to provide water for their stock by manual labor.

A tank of any required size may be built under the roof of a house or barn, and kept full by this pump whenever the wind blows. The waste or overflow of water may be prevented by means of a floating ball and cock in the tank. The entire machine is simple, durable, and cheap, and should be in general use.

W. S. CLARK,
President Mass. Agricultural College.

ELMWOOD, February 21, 1874.

MESSRS. HARTFORD PUMP CO.:

The Automatic Windmill Pump you put up for me last June has given great satisfaction. It has given me an abundant supply of water, with no trouble, comparatively speaking.

It has supplied bath-room, water-closet, wash-tubs, etc., and I believe it capable of furnishing three times the amount of water I use. I consider it an indispensable luxury, and recommend it to all who now have to pump by hand, for house and farm purposes, as a good investment.

Yours truly,
GEORGE W. LOOMIS.

MILFORD, Mass., October 3, 1874.

GENTLEMEN OF THE HARTFORD PUMP CO.:

Please find check as per bill. Your pump works well, and I am perfectly satisfied with it.

Several have called to see it, from other towns, and I doubt not that in the course of time you will have several applications for the pump in this vicinity. Please return receipt.

Very truly yours,
M. RICHARDSON.

To show further the interest the subject possesses and the favorable opinions of those who have looked into the matter, a few extracts from well-known papers are appended. The cuts referred to are omitted.

From the American Agriculturist, of October, 1874.

Among the various contrivances for raising water to elevated positions, whence it may be conducted about the house, and to the barns and stock-yards, the Automatic Windmill Pump, of the Hartford Pump Co., is notable for its simplicity and convenience, as well as for the ingenuity evinced in its construction, and the application of well-known principles. The reverse of the principle by which we suck cider through a straw, may be said to be shown, when by blowing air into a tight vessel filled with liquid, having an open tube descending to near the bottom, we force the liquid to spout out through the tube. This is illustrated in Fig. 1. A barrel, containing water, has a tube passing through the top, and going below the water. Now, if we pump air in by means of an air-pump, we shall pump water out. If the barrel be submerged in a well, and has a valve in the bottom, when it is emptied of water, turning a cock in the air-pipe, to let the air escape, it will be filled with water again. Thus we might, by pumping air into a well, obtain a regular supply of water. The pump which we describe works precisely upon this simple principle. Chambers are placed in the well or spring—anywhere under water—a windmill works an air-pump, and the water may be raised to any desired height. In order to maintain a constant stream, two chambers are employed; and thus, when one is exhausted, that is filled with air; by a simple contrivance the air is conducted to the full chamber, and the first quickly refills itself with water, so that there is no perceptible break in the flow. To accomplish this, the chambers are balanced upon a frame having a motion of two or three inches, and the buoyancy of the one filled with air is sufficient to turn a cock, which both conducts the air to the opposite chamber, and lets that which itself contains, blow off, as the water from without rushes in.

When we come to examine this interesting contrivance, we see that after all it differs less than one might suppose, from some common forms of pumps. For instance, in the old-fashioned fire-engines, see Fig. 2, we have two cylinders, working alternately.

These are filled from below, and the water passes out from below, in the same manner as it does in the Automatic Pump. The pressure which forces the water out is, however, as in nearly all other pumps, applied by means of a tight-fitting piston, with its piston-rod, joints, diagonal pressure, etc., all of which involves of necessity a great degree of friction. In this pump, the air pressing upon the surface of the water, is piston, piston-rod, and all, working without a perceptible amount of friction—one may say, none at all, and with a force which has only its *economical* limits. Practically 100 to 125 feet is as high as it is desirable to force the water *at one lift*, but with a succession of pumps, this lifting may be indefinitely repeated.

The friction, or loss of power, in the slow passage of air through tubes, is exceedingly small, unless indeed the pressure be very great, and the tube small, in which case, however, the air will move very rapidly. Practically it is found that there is no perceptible loss of power, when quarter and three-eighths inch lead or iron pipes are used to conduct the air. This makes it practicable to place the wind-wheel at any desired distance from the well or spring: even a quarter or half a mile away, if a suitable position for it cannot be found nearer. This is a decided advantage, as springs are usually situated in valleys, where a windmill could hardly be placed to work with power and regularity, unless, perhaps, upon a lofty tower.

* * * * * * * *

The absolutely silent working of the apparatus is a great point in its favor, as well as the fact that, though the windmill is not "self-regulating" in the ordinary acceptation of that term, it nevertheless is so strongly made that the most violent storms, except such perhaps as might unroof the barn upon which it stands, have no other effect upon it than to make it pump the more. No rapidity of pumping can cause it to suck up gravel and so derange the pump, as windmill pumps so often do. It is necessary to oil it once a month, and this is literally all the attention it requires.

From the Manufacturer and Builder, for June, 1874.

PRIVATE WATER-WORKS.

There is indeed no greater boon than the possession of a plentiful supply of water for a house, and it is one of the advantages enjoyed in a properly-managed city that it possesses water-works, by means of which each house, if desired, may be supplied with this element so absolutely necessary to health and comfort in the household.

Thanks to the efforts of the Hartford Pump Company, of Hartford, Conn., each country residence may now enjoy the same advantages, and at an expense insignificant when compared with the inestimable results, be supplied with water, in such a way as to have always a plentiful supply, which can be drawn as well in different rooms of the house as in the kitchen, bath-room, stable, etc. Every one is satisfied that if water has constantly to be drawn by pumping, or still worse, by more primitive arrangements, an injurious economy in its use is always the result, and that this is especially the case on farms, no one will doubt. A mechanical way, therefore, by which plenty of water can be raised in a reservoir not only from a neighboring well, but even from a distant brook, so as to save cattle the daily journey through all kinds of weather, is a desideratum which especially stock-farmers will appreciate, not to speak of the household comforts depending on such provisions.

We have on several former occasions called attention to windmills, and how in some parts of the world windmill power holds its own against the modern competition of steam power (see our numbers for August, 1869, and for June, 1870, where a detailed and illustrated description is given of colossal windmills of great power). This is solely due to their solidity of construction, and the total absence of complicated self-regulating patent devices, which have been the cause of the abandonment of windmills here, as their arrangements for perfection were so very delicate as to disable them in the first storm they had to endure.

This indeed has been the fate of almost all the windmills in the United States, the operation of which we have been watching for the last twenty-five years. They were comparatively mere toys, without sufficient strength, and by their complexity, totally inadequate to stand any unusual strain. The Hartford Pump Co., in applying wind power to raise water, have overcome the above objection, to which all such small mills have thus far been subject, by two devices: first, by great simplicity of construction, combined with a strength which will stand a storm; and second, by not having the power directly attached to the rigid water-pump pistons, as these act on the practically incompressible water, they subject the machinery to a continually changing strain; and if this transmission of power were accomplished by the intervention of some elastic medium, all unequal and changeable strain may be removed from the windmill. Such a medium is the air, and it is this which is made use of by the Hartford Pump Co.

From the Rural New Yorker, June 6, 1874.

THE HARTFORD AUTOMATIC PUMP.

There are not many country houses in which one finds a plentiful and convenient supply of water. This is not entirely because plumbers' bills are large, for the same people who occupy these houses would never dream of building in the city without putting in plenty of pipes and basins and a boiler in the kitchen. It is merely because they are not acquainted with any satisfactory means of bringing their well or spring water to their upper floors without a good deal of hand labor. We have lately seen a machine made by the Hartford Pump Company, of Hartford, Conn., that apparently does this work, and keeps the house supplied without trouble, and at little or no cost beyond the first investment. In the belief that we are doing our readers a favor by introducing to their notice one of the best means yet devised for securiug an abundant supply of water for the house and barns, we herewith give cuts and a description of the Automatic Pump.

* * * * * * * *

The device is an ingenious one, and is claimed to be the first thoroughly successful attempt to force a continuous stream of water for ordinary use by compressed air. The plan has many advantages to commend it—in economy of power, convenience, and general applicability—and bids fair to come into general use. We should say that practical tests are not wanting, as some machines have been in daily use for the past year, and are strongly commended by their owners.

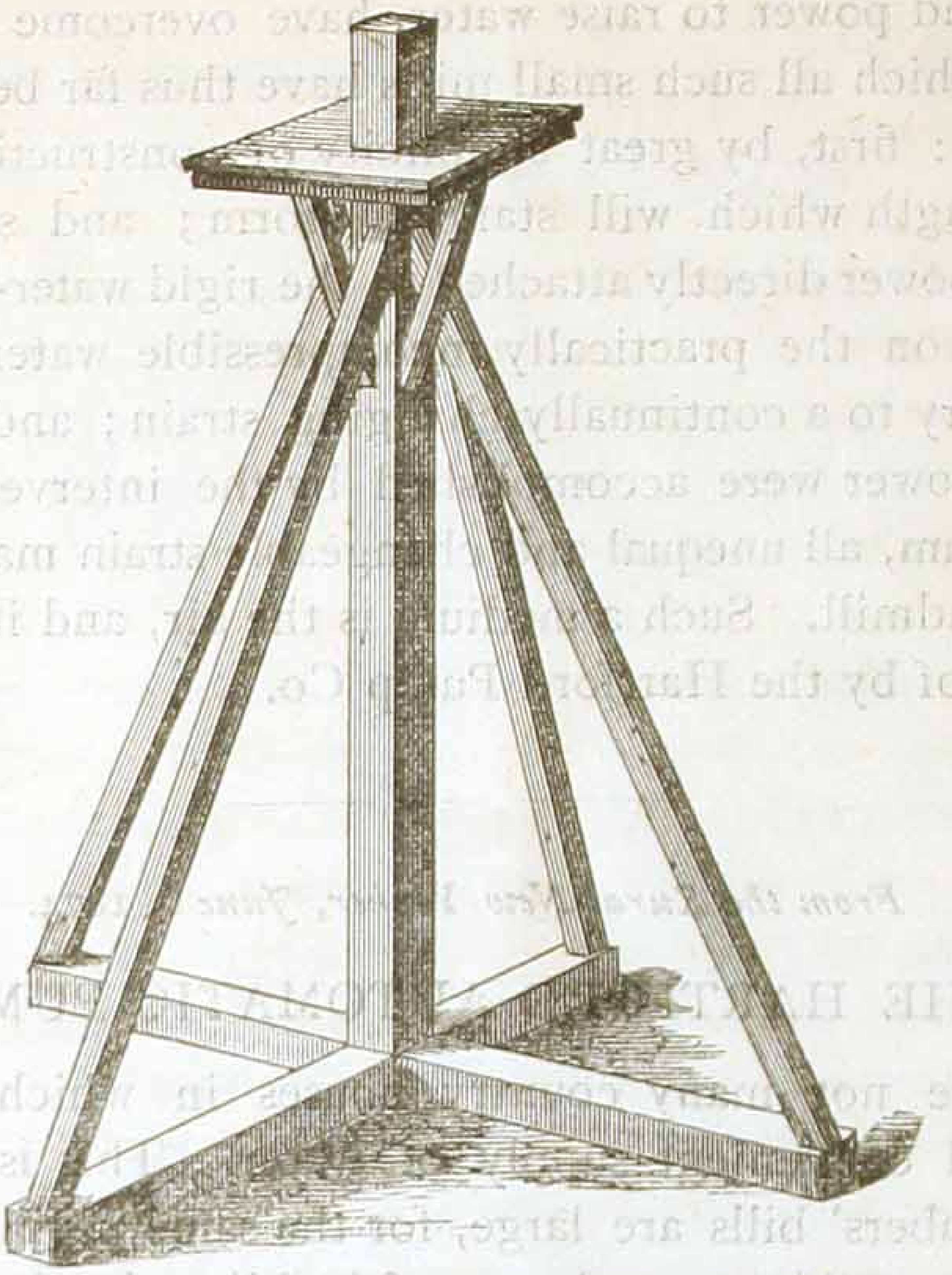

FIG. 4.—Post for Windmill. Wooden Braces.

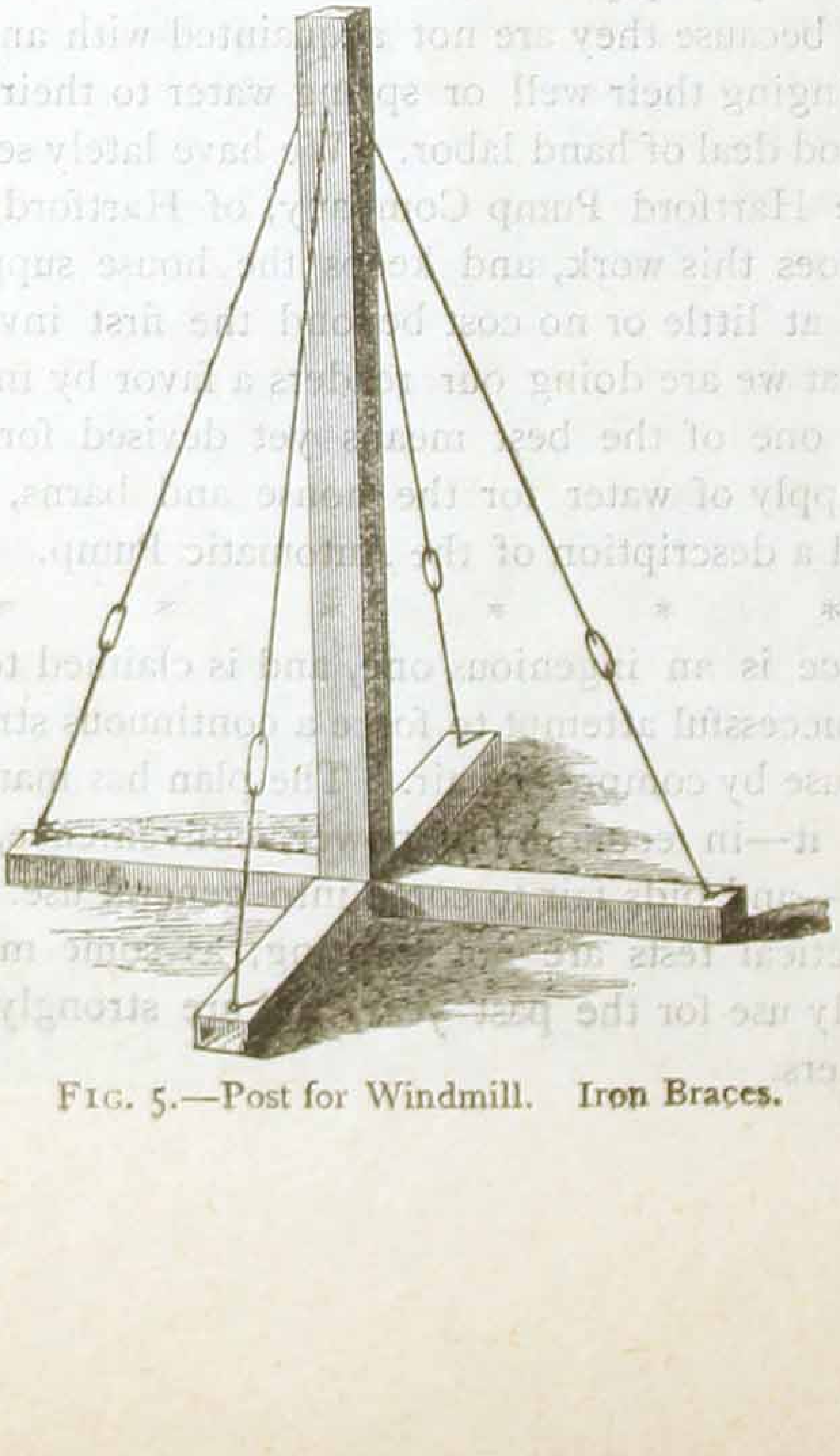

FIG. 5.—Post for Windmill. Iron Braces.

From the Technologist for July, 1874.

A CHEAP METHOD OF RAISING WATER.

Few engineers, who have given careful attention to the subject, have any doubt that the cheapest and simplest means of raising water from wells or cisterns is wind-power, which in some countries is very extensively used for this purpose.

* * * * * * * *

And besides this, with all the ordinary forms in market, it is necessary to place the windmill directly over the well, and this, in many cases, renders the use of this very convenient source of power undesirable, from the objectionable appearance which it presents. Few persons, owning elegant mansions, care to have them disfigured by a windmill in close proximity, though of course in some situations, and with some styles of architecture, a windmill might be made to add to the picturesque appearance of a dwelling.

In order to avoid these difficulties, the Hartford Pump Company have devised an arrangement whereby the windmill is not applied directly to the raising of the water, but is first used for compressing air into a proper reservoir, and then, by means of a very ingenious contrivance, the compressed air is employed for raising the water to any required elevation. The windmill, as will be seen from Fig. 1, is of the simplest and strongest construction. There are no complicated regulators to get out of order, and the arms and vanes are sufficiently strong to resist anything short of a hurricane.

* * * * * * * *

The simplicity and efficiency of this apparatus has much to commend it.

Fig. 4 represents one of the best modes of putting up the mill, when not placed on a barn or out-building. A post twelve feet high should be at least six inches square, and the sills about the same size as the post, and about the same length. The braces may be three by four inches. If the post is from twelve to twenty feet it should be seven or eight inches square, and the other parts in proportion. The braces should be bolted to the sills, and it is well to bolt them through the upper ends also, the bolts passing through the post; but in that case the post should be seven inches in diameter. The platform at the top may be from

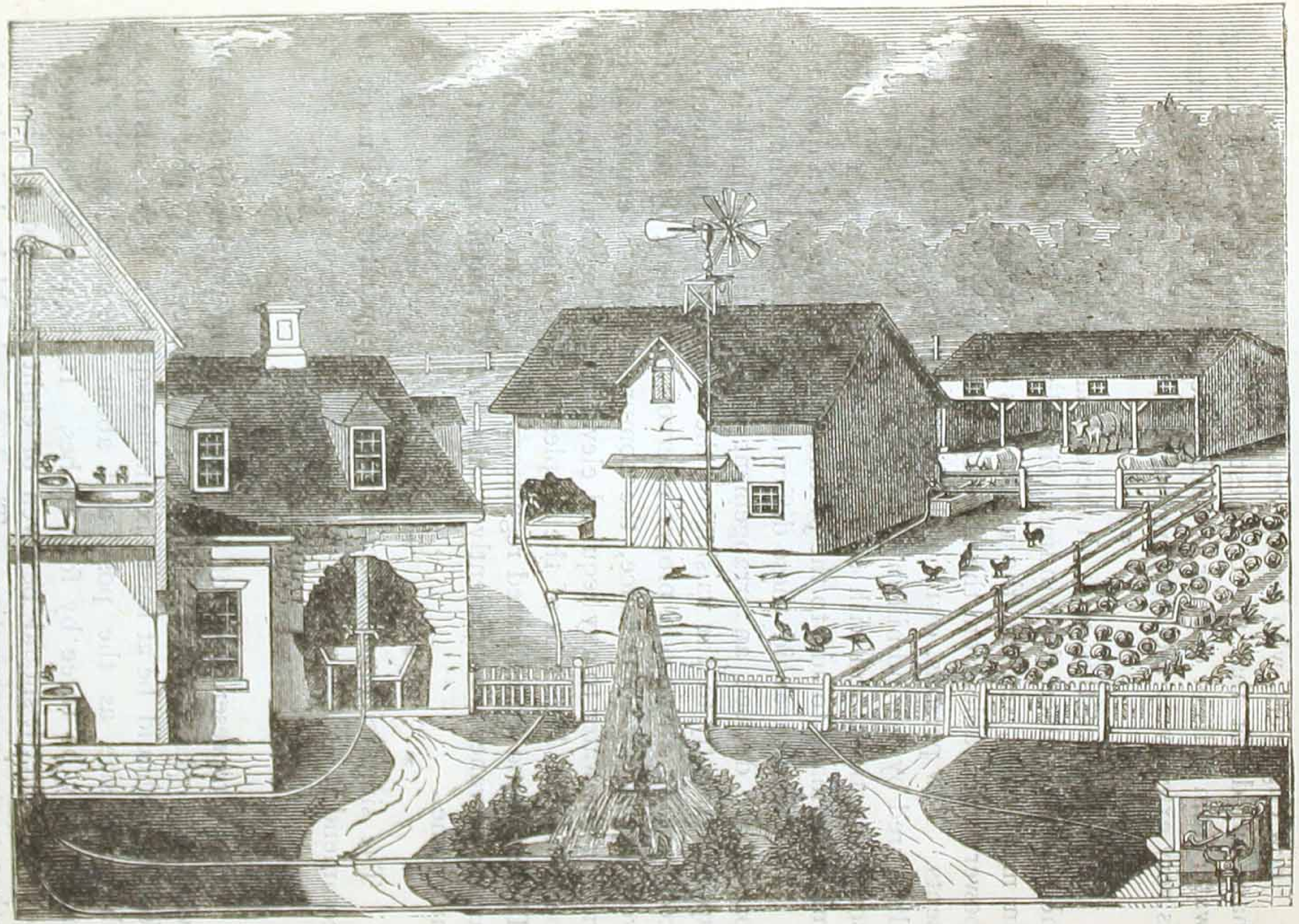

FIG. 6.—House, Barn, Cattle-sheds, etc., supplied by 7½-feet Wheel, erected on the Barn, and taking water from a spring at a distance.

three to six feet square. The sills and post may be buried to a depth of four feet, or placed on the surface, and the ends of the sills bolted to posts or rocks set in the ground. The above specifications are for No. 2 wheel; for No. 3, add two inches to diameter of post, and brace in proportion. A cheaper way of setting the mill is shown in Fig. 5. Iron rods set up with turn-buckles are used and the platform dispensed with.

TO SET THE WINDMILL.

Place the windmill casting on the post, chamfering the latter nearly to fit the casting, but leaving it so large that the casting will not come quite down. The bolts by which this casting is held to the post run directly downward. At a suitable distance from the top of the post mortice in holes just large enough to let a nut slide in far enough to admit of the bolts passing through. Thus the nut is held in place, and, by turning the bolt, the casting is drawn tight. In the same way it can be tightened when the wood shrinks.

TO SET THE PUMP.

Connect on to the upright water main the necessary length of pipe to reach to the point where the pipe is to be run out of the well, say four feet or so below the surface of the ground. Then connect on the air pipe and clamp it to the water main to hold firm. Now lower the pump, set it firmly in the centre of the well, and brace the main from the sides of the well down as near to the chambers as the water will permit. Now connect all pipes and the pump is ready for operation. The air pipe should not be covered up in the trench until the joints have been carefully tested. This may be done by connecting the pipe at the air pump, closing the lower end of the pipe at the automatic pump, and turning the wheel by hand, if there is no wind, until a high pressure is attained. Then, by carefully examining each joint, any leaks will be readily discovered and stopped. The air pipe once made tight, will remain so. Too much care cannot be exercised in this respect, as it is much easier and cheaper to be thorough at first than to have the work to do over again through carelessness. It only requires the proper application of the pipe-wrench and red lead to make tight.

OILING.

Oiling.—The oilers on crank and journal boxes must be kept filled, and inspected as often as experience dictates. If they run dry, the machine will begin to squeak, and, if left in such condition, may be seriously injured, or even ruined. The cup into which the Air Pump dips at each stroke must also be kept filled. Usually these various cups should be filled about once a week. Any good lubricating oil, that will stand cold weather, may be used in the cups. *Poor oil* will, infallibly, make trouble. Lard oil, of first quality, may be used in warm weather.

SIZE OF WELL.

The water chests need at least 30 inches of space in the longest direction, though the smallest size can be made to work in a little less. If a well is dug for the purpose it is better to make it large enough to allow of the accumulation of a considerable amount of water when the pump is not working. In making a well by the side of a brook, or pond, or spring, care should be taken to make it deep enough to secure, at all times, at least 2½ feet depth of water. It is better, of course, to curb with brick or stone, though a large hogshead answers a very good purpose, and will last a long time. In either case the well should be so made that it can be securely closed in winter as a protection from frost.

SIZE OF PIPE.

For air pipe we invariably use one half inch iron pipe. For the water main one inch pipe is ordinarily sufficient for the supply of a house. When the water must be forced more than 1000 feet horizontally, and over 60 feet high, 1¼, or, better still, 1½ inch pipe should be used. When extraordinary quantities of water are wanted, of course the pipe should be correspondingly larger.

Some Advanatges of this Apparatus.

1st.—As there is no suction, and the water is always raised by direct pressure of the air, which may be carried any required distance in pipes, the windwheel may be placed wherever desired, with reference to appearance, exposure, etc., even several hundred feet from the well.

2d—Where water is to be raised from a deep well, we save all the power used in moving a cumbrous system of rods, extending down fifty, or even a hundred feet from the windmill; our only connection between the windmill and pump being a pipe for conveying the air.

3d.—The application of power is economical, as the great elasticity of air prevents loss from sudden and violent resistance at the beginning of the stroke, such as must occur when a plunger is driven into water.

4th.—The stream is constant, instead of interrupted, as in the ordinary pump, therefore more water will be delivered through a pipe of the same size, at the same pressure.

5th.—The elastic quality of air makes it possible to use fixed instead of self-adjusting fans on all wheels of a moderate size, giving a large gain in simplicity.

6th.—As the fans and rudder are fixed, instead of hinged, the machine is noiseless in its operation.

7th.—The machine is most effective when the wind is highest, while a self-regulating wind-wheel has a fixed limit of speed which it cannot pass, and so has no increased efficiency in a gale.

8th.—Owing to the saving of power, and the gain at a high speed, a smaller pump and wind-wheel can be used to produce any desired result.

9th.—The wind-wheel is so light that no heavy framework is required.